

# Problem 1-11

## Part 1:

Let  $\xi_A$  be the extent of Reaction A and  $\xi_B$  be the extent of Reaction B.

Stoichiometric Table:

Species:	Initial	Final	
Benzene	100	$100 - \xi_A$	$= 35$
Ethylene	100	$100 - \xi_A - \xi_B$	$= 2$
Ethyl Benzene	—	$\xi_A - \xi_B$	$= 39$
Diethyl Benzene	—	$\xi_B$	$= 19$

From the above table, we have 4 equations and 2 unknowns. Two equations will be used to calculate  $\xi_A$  and  $\xi_B$ . These values must then satisfy the

remaining 2 equations if the data are consistent with the hypothesis that Reactions A and B are the only reactions taking place.

From "Benzene",

$$100 - \xi_A = 35 \Rightarrow \xi_A = 65$$

From "Diethyl Benzene",  $\xi_B = 19$

For "Ethylene",

$$100 - 65 - 19 \stackrel{?}{=} 2 \Rightarrow 16 \neq 2$$

For "Ethyl Benzene",

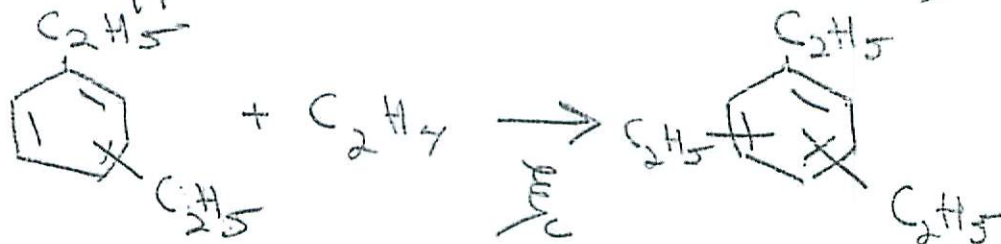
$$65 - 19 \stackrel{?}{=} 39 \Rightarrow 46 \neq 39$$

## Part 2:

It seems logical that some triethyl benzene

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might be formed, although there is no indication that an attempt was made to measure this species. Suppose there is a third reaction,



Then:

$$\text{Benzene: } 100 - \sum_A = 35 \Rightarrow \sum_A = 65$$

$$\text{Ethylene: } 100 - \sum_A - \sum_B - \sum_C = 2$$

$$\text{Ethyl benzene: } \sum_A - \sum_B = 39; \sum_B = \sum_A - 39 = 26$$

$$\text{Diethyl benzene: } \sum_B - \sum_C = 19; \sum_C = \sum_B - 19 = 7$$

Checking ethylene

$$100 - 65 - 26 - 7 \stackrel{?}{=} 2 \Rightarrow 2 = 2$$

Hypothesis is consistent with data.